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Statistical analysis of the evolution of wave fields to assess the occurrence of extreme ocean waves using buoy data.

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This research investigates the statistics properties of a wave fields using buoy data.
The research is of practical engineering importance since waves are directional and since the majority of the engineering applications are located in finite water depth. Moreover, an improved determination of the probability of occurrence of extreme (and therefore unexpected) waves for certain sea conditions can result in improved warning criteria and therefore also to improved safety at sea.
It is now well accepted that modulational instability, known as one of the main mechanisms for the formation of rogue waves, induces strong departures from Gaussian statistics. However, whereas non-Gaussian properties are remarkable when wave fields follow one direction of propagation over an infinite water depth, wave statistics only weakly deviate from Gaussianity when waves spread over a range of different directions. Over finite water depth, furthermore, wave instability attenuates overall and eventually vanishes for relative water depths as low as kh=1.36 (where k is the wavenumber of the dominant waves and h the water depth). An analysis of the statistical properties (i.e. wave crest and wave height distributions) from buoy measurements provides information of the probability of occurrence of extreme waves.